Hurricane and Storm Damage Reduction Projects
Data Collection, Data Evaluation and Risk-Based Analysis

Thomas D. Smith, P.E.
Planning Division
U.S. Army Engineer District, Jacksonville
Jacksonville, FL

Introduction

The U.S. Army Corps of Engineers (USACE) has been involved in the placement of sand on our nations beaches for over 60 years. Initial project purposes of national defense and recreation have given way to protection of upland development. Federal "beach erosion control" projects prior to 1986 were designed to optimize recreation benefits through widening of the dry beach berm and control of future erosion. Landmark legislation included in the Water Resources Development Act of 1986 refocused Federal participation in beach building away from recreation to "shore protection". Federal shore protection projects have subsequently been formulated to optimize economic benefits generated from the protection of upland development and reduction of land loss. Today such Federal projects are called "hurricane and storm damage reduction" project in recognition of their primary purpose.

Policy Guidance

Like other Federal water resource projects, hurricane and storm damage reduction (H&SDR) projects are formulated through comparison of without- and with-project damages. Project width is determined through identification of the berm width extension that optimizes primary net benefits (total estimated storm damage reduction benefit minus estimated cost). This plan is referred to as the National Economic Development (NED) plan. Federal participation is warranted if the total benefits (primary and incidental) of the NED plan result in a benefit-to-cost ratio greater then one (1.0).

Sections 3 and 4 of USACE Engineer Regulation (ER) 1105-2-100, dated 22 April 2000, identifies acceptable types of improvements, specific policies and an evaluation framework to follow in the planning of H&SDR projects. Appendix E of the ER provides specific evaluation framework and additional information concerning project development. As part of the evaluation requirements, a risk-based economic analysis is to be performed utilizing a life-cycle approach that includes a probabilistic evaluation and display of benefits and costs. Key considerations to the risk-based analysis include damage functions (erosion, water stage elevation and waves), storm related parameters, shoreline and/or volume changes and post-storm beach profile recovery.

Implementation

To comply with the ER, many USACE districts have developed computer models to assist in the risk-based assessment of potential project outputs. To date, the damage functions used in the models have been based on anecdotal evidence that is undocumented and not peer reviewed. Also, there is a considerable degree of uncertainty in the state-of-the-art capability to predict beach profile storm response and long-term shoreline evolution. These assumptions are key components of the Federal feasibility assessment process. Since 1995, when the Administration declared H&SDR projects as low priority, very little Research and Development (R&D) has been funded to improve the situation. Higher headquarters and the Assistant Secretary of the Army's staff have commented on inherent assumptions, validation and verification of the district models. These comments have resulted in delay and in some cases denial of report approval.

The Institute of Water Resources (IWR), through funding provided by Headquarters, USACE, has recently initiated a work unit to develop a generalized risked-based H&SDR benefit model. The goal of the work unit is to provide a computer model that can be customized on a site-specific basis to meet the requirements of Army regulations. Issues being addressed by the work unit include quantification of parametric variability, identification of significant parameters, uncertainty distributions of the various parameters and how to incorporate coastal processes model output into a risk-based analysis tool.

Numerous model assumptions still require field verification. Post-storm investigations are necessary to identify erosion versus wave induced damages, foundation types and damage modes. Wave characteristics, storm tracks and storm duration are also essential to the analysis. In addition, modelers need field data documenting inundation damages to structures and their contents along with delineation of the threshold between wave versus wind induced damages. Efforts to acquire existing field data have been unsuccessful. Little information on what actually caused damage (erosion, water, waves and/or wind) has been found. A draft scope of work for post-storm field investigations has been developed, but remains unfunded. The work unit is still trying to acquire Federal Emergency Management Administration (FEMA) claims data with locational information. In the past, FEMA has not been receptive to providing data that identifies specific structure location. As an alternative, expert elicitation protocol may need to be solicited to develop damage relationships (similar to approach in riverine flood damage to verify relationships developed from self-reported data). The design document for the conceptual H&SDR benefit model and the initial data structure for proof of concept model have been completed. IWR is working with the Coastal Hydraulics Laboratory on a shoreline response database. The database is necessary for the proof of concept model (scheduled for completion in April 2002). A working prototype computer model is scheduled for release in June 2002.

Conclusions

Army regulations stipulate quantification of project benefits and costs through a risked-based life cycle analysis. R&D to address project benefits under this framework is under funded while virtually no funds have been allocated to address project costs. Securing long-term funding for field investigations, model development and technology transfer is critical to H&SDR project execution and mission success.